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Effects of increasing dried distiller's grains on feed intake

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EFFECTS OF INCREASING DRIED DISTILLER'S GRAINS ON FEED INTAKE

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Summary

Recent studies have shown that dried distiller's grains with solubles (DDGS) has an ME value similar to that of corn, but pigs fed diets with DDGS have a lesser feed intake than do those fed corn. We conducted three studies to evaluate the effects of DDGS on palatability and feed intake of growing pigs. In Exp. 1, 90 gilts (initially 58.2 lb) were used to evaluate the effects of a diet based on corn-soybean meal, alone or with 30% DDGS from two different sources, on feed preference. Source 1 DDGS was obtained from an ethanol plant built before 1990 and source 2 was obtained from a plant built after 1990. Each pen of pigs had two feeders, one with the corn-soybean meal diet and the other with one of the DDGS sources. There were 10 pens with six pigs per pen and 10 pens with 3 pigs per pen, for a total of 90 gilts; all pigs were blocked by weight. The location of the feeders was moved morning and evening each day. From d 0 to 7, there were no differences in ADFI among the dietary treatments. From d 7 to 13 and overall (d 0 to 13), however, feed intake was less ($P<0.01$) for both DDGS diets, when compared with the corn-soybean control.

In Exp. 2, 187 barrows and gilts (initially 52.1 lb) were used to examine the effects of

increasing DDGS (source 2) in a 21-d preference study. Treatments consisted of a control diet based on corn-soybean meal, or the control diet with 10, 20, or 30% DDGS. There were 17 pigs per pen and 11 pens. There were four feeders in each pen, each containing a different diet, and the feeders were moved every morning and evening during the trial. During each week for the overall trial, increasing DDGS decreased (linear; $P<0.001$) ADFI.

In Exp. 3, 120 barrows and gilts (initially 41.7 lb) were used to examine the effects of Sucram[®], a feed flavor additive, in corn-soybean meal diets, with and without 30% DDGS (source 2), on feed intake in a 21-d preference study. Treatments consisted of a control diet based on corn-soybean meal, or the control diet with 30% DDGS, both with or without Sucram[®]. There were 15 pigs per pen and 8 pens. Each pen contained all four dietary treatments in individual feeders and the feeders were moved every morning and evening during the trial. For the entire trial, adding DDGS to diets decreased ($P<0.001$) ADFI. Adding Sucram[®] had no effect ($P>0.33$) on feed intake in either the corn-soybean meal or DDGS diets.

These studies demonstrate that pigs prefer corn-soybean diets to diets containing DDGS. For these experiments, the source of DDGS or

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the addition of a feed flavor did not change palatability. Although it seems that the ME content of DDGS could be comparable to that of corn, palatability problems may affect pig performance, even when DDGS included at low rates in the diet.

(Key Words: Pigs, Feed Intake, DDGS.)

Introduction

Recent studies have shown that distiller's dried grains with solubles (DDGS) has higher nutrient values than previously reported by the National Research Council. These studies have shown that the ME of DDGS is similar to that of corn. A large number of new ethanol plants, which produce DDGS as a by-product, have increased the availability and feasibility for use in swine diets. Traditionally, DDGS has been fed to ruminants because it has less lysine and more fiber content than do other ingredients typically fed to pigs. New ethanol plants use advanced processing techniques and better quality control, which may lead to higher quality and a more consistent nutrient profile of DDGS than what older ethanol plants produce. Previous studies at KSU have shown that feed intake was less for pigs fed diets containing DDGS. The objective of this study was to evaluate the effects of source and rate of DDGS on feed intake in growing pigs.

Procedures

In Exp. 1, a total of 90 gilts (initially 58.2 lb) were blocked by weight and were allotted randomly to one of two dietary treatments. Treatments consisted of pens with two feeders; each pen received a diet based on corn-soybean meal, or the control diet with 30% DDGS from one of two different sources replacing corn. Source 1 DDGS was obtained from an ethanol plant built before 1990 and source 2 was obtained from a plant built after 1990 (Table 1). There were 10 pens with 3 pigs/pen and 10 pens with 6 pigs per pen, for a total of 10 pens per DDGS source. Each pen

was 4 × 8 ft, with completely slatted flooring and two nipple waters. Feeder weights were measured every 7 d to determine ADFI, and pigs were weighed at the beginning and conclusion of the trial to calculate ADG and F/G. Overall ADG and F/G were 1.90 lb and 1.54 respectively. Feeder location was switched every morning and evening. This trial was conducted in the K-State Segregated Weaning Facility.

In Exp. 2, a total of 187 barrows and gilts (initially 52.1 lb) were blocked by sex in a 21-d preference study. There were 17 pigs per pen and 11 pens used in this study; each pen was 10.5 ft × 10.3 ft, with completely slatted flooring and two nipple waterers. Dietary treatments consisted of a control diet based on corn-soybean meal, or the control diet with 10, 20, or 30% DDGS from source 2 (Table 2). All four treatment diets were provided in each pen by a one-hole self feeder. Feeders were rotated clockwise one position every morning and evening. Feeder weights were taken every 7 d to determine ADFI, and pigs were weighed at the beginning and end of the trial to calculate ADG and F/G. For the overall trial, ADG and F/G were 2.13 lb and 1.83, respectively. This trial was conducted at the K-State Swine Teaching and Research Facility.

In Exp. 3, a total of 120 barrows and gilts (initially 41.7 lb) were blocked by sex in a 21-d preference study. There were 15 pigs per pen and 8 pens used in this study; each pen was 10.5 ft × 10.3 ft, with completely slatted flooring, and two nipple waterers. Treatments consisted of a control diet based on corn-soybean meal, with or without Sucram[®], or the control diet with 30% DDGS (source 2; Table 3), with or without Sucram[®]. Sucram[®] is a feed flavor additive. Our objective was to see if an added flavor agent might mask the negative effects of DDGS on palatability. Each of the four treatment diets was provided in each pen with a one-hole self feeder. Feeders were rotated clockwise one position every morning and evening. Feeder weights were

taken every 7 d to determine ADFI, and pig weights were taken at the beginning and end of the trial to calculate ADG and F/G. For the overall study, ADG and F/G were 1.49 lb and 1.90, respectively. This trial was conducted at the K-State Swine Teaching and Research Center.

Results and Discussion

In Exp. 1, from d 0 to 7, there were no differences ($P>0.58$) in ADFI between the control and DDGS diets (Table 4). But feed intake was numerically less for both DDGS sources than for the control diet. From d 7 to 13 and overall (d 0 to 13), ADFI was greater ($P<0.01$) for pigs fed the control diet than for pigs fed either DDGS source.

In Exp. 2, for each week and for the overall trial, increasing DDGS decreased (linear; $P<0.001$) ADFI. The differences observed in the first week of the study were similar to those observed at the end, suggesting that pigs did not become accustomed to the DDGS and begin to eat more of this diet.

In Exp. 3, for the entire trial, adding DDGS to diets decreased ($P<0.001$) ADFI, compared with the ADFI of pigs fed control diets. There was no difference ($P<0.33$) in feed intake with the addition of Sucram[®] in either the control or DDGS-based diets. The addition of Sucram[®] does not increase feed intake when added to diets with 30% DDGS.

These studies demonstrate that the inclusion of DDGS decreased feed intake, and that pigs do not become acclimated to DDGS over time. These experiments demonstrate that pigs prefer corn-soybean diets to diets containing DDGS. Furthermore, feed intake decreased with increasing amounts of DDGS added to the diet. Regardless of DDGS source used in these trials, feed intake was decreased when DDGS was included in diets, and the addition of feed flavors did not increase palatability. Although it seems that the ME content of DDGS could be comparable to that of corn, palatability problems may affect pig performance, even when DDGS is included at low rates in the diet.

Table 1. Composition of Experiment 1 Diets (As-fed Basis)^a

Item	Control	Dried Distiller's Grains with Solubles	
		Source 1	Source 2
Corn	57.43	28.07	28.07
Dried distiller's grains w/ solubles ^b	-----	35.85	35.85
Soybean meal, 46.5% CP	35.85	3.00	3.00
Soybean oil	3.00	30.00	30.00
Monocalcium phosphate, 21% P	1.50	0.75	0.75
Limestone	1.00	1.25	1.25
Salt	0.35	0.35	0.35
Vitamin premix	0.25	0.25	0.25
Trace mineral premix	0.15	0.15	0.15
L-Threonine	0.09	-----	-----
Lysine HCl	0.25	0.33	0.33
DL-Methionine	0.13	-----	-----
TOTAL	100.00	100.00	100.00
Calculated Analysis:			
Lysine, %	1.44	1.44	1.44
Methionine, %	0.48	0.50	0.50
Threonine, %	0.92	1.12	1.12
ME, kcal/lb	1,555	1,588	1,588
Protein, %	21.73	29.22	29.22
Ca, %	0.80	0.80	0.80
P, %	0.72	0.71	0.71
Available phosphorus, %	0.39	0.40	0.40

^aAll diets fed in meal form.^bSource 1 was from a plant built before 1990 and source 2 was from a plant built after 1990.

Table 2. Composition of Experiment 2 Diets (As-fed Basis)^a

Item	Control	Dried Distiller Grains with Solubles,%		
		10	20	30
Corn	60.74	52.82	45.19	37.54
Soybean meal, 46.5% CP	30.60	28.70	26.45	24.20
Choice white grease	6.00	6.00	6.00	6.00
Dried distiller's grains w/ solubles ^b	-----	10.00	20.00	30.00
Monocalcium phosphate, 21% P	0.70	0.50	0.30	0.10
Limestone	0.93	0.98	1.05	1.13
Salt	0.35	0.35	0.35	0.35
Vitamin premix	0.15	0.15	0.15	0.15
Trace mineral premix	0.15	0.15	0.15	0.15
Antibiotic ^c	0.20	0.20	0.20	0.20
Lysine HCl	0.15	0.15	0.16	0.18
DL-Methionine	0.03	-----	-----	-----
TOTAL	100.00	100.00	100.00	100.00
Calculated Analysis				
Lysine, %	1.20	1.20	1.20	1.20
Methionine, %	0.34	0.34	0.36	0.40
Threonine, %	0.74	0.79	0.84	0.88
ME, kcal/lb	1,632	1,647	1,662	1,677
Protein, %	19.39	20.61	21.68	22.75
Ca, %	0.60	0.60	0.60	0.60
P, %	0.53	0.53	0.53	0.52
Available phosphorus, %	0.22	0.23	0.24	0.25

^aAll diets fed in meal form.^bThe DDGS was from source 2, a plant built after 1990.^cCarbodox (fed at a rate of 50g/ton).

Table 3. Composition of Experiment 3 Diets (As-fed Basis)^a

Item	Control	Dried Distiller's Grains with Solubles
Corn	67.47	38.11
Soybean meal, 46.5% CP	30.00	30.00
Dried distiller's grains w/ solubles ^b	-----	30.00
Monocalcium phosphate, 21% P	0.79	0.00
Limestone	0.92	1.18
Salt	0.35	0.35
Vitamin premix	0.15	0.15
Trace mineral premix	0.15	0.15
Lysine HCl	0.15	0.05
Sand or Sucram [®]	0.02	0.02
TOTAL	100.00	100.00

Calculated Analysis:

Lysine, %	1.20	1.28
Methionine, %	0.31	34
Threonine, %	0.76	77
ME, kcal/lb	1,510	1,555
Protein, %	19.68	25.50
Calcium, %	0.62	0.62
Phosphorus, %	0.56	0.54
Available phosphorus, %	0.24	0.24

^aAll diets fed in meal form.^bThe DDGS was from source 2, a plant built after 1990.**Table 4. Effects of Dried Distiller's Grains With Solubles (DDGS) Source on Feed Preference, Exp. 1^a**

ADFI, lb/d	Control	DDGS		SE
		Source 1	Source 2	
Day 0 to 7	1.56	1.33	1.33	0.433
Day 7 to 13	2.40 ^b	0.92 ^c	1.07 ^c	0.445
Day 0 to 13	1.95 ^b	1.14 ^c	1.21 ^c	0.435

^aMean represents a total of 90 gilts, initially 58.2 lb, given choice of corn-soybean meal diet or corn-soybean meal diet with 30% DDGS from one of two sources. Overall group ADG was 1.90 lb and F/G of 1.54.^{b,c}Means having different superscript letters within a row differ ($P < 0.01$).

Table 5. Effects of Increasing Dried Distiller's Grains (DDGS) on Feed Preference, Exp. 2^a

ADFI, lb/d	Control	DDGS, %			P- Value		SE
		10	20	30	Linear	Quadratic	
Day 0 to 7	1.07 ^b	0.85 ^c	0.75 ^c	0.49 ^d	0.001	0.79	0.064
Day 7 to 14	1.96 ^b	1.20 ^c	0.63 ^d	0.22 ^e	0.001	0.02	0.069
Day 14 to 21	2.10 ^b	1.43 ^c	0.80 ^d	0.30 ^e	0.001	0.24	0.070
Day 0 to 21	1.71 ^b	1.16 ^c	0.73 ^d	0.34 ^e	0.001	0.13	0.052

^aA total of 187 pigs (17 pigs per pen and 11 pens), initially 52.1 lb, were given the choice of one of four diets in the same pen: corn-soy control or control with DDGS (Source 2) replacing corn. Overall group ADG was 2.13 lb and F/G was 1.83.

^{b,c,d,e}Means having different superscript letters within a row differ ($P < 0.05$).

Table 6. Effects of Dried Distiller's Grains with Solubles (DDGS) and Sucram® on Feed Preference, Exp. 3^a

ADFI, lb/d	Corn - SBM		30% DDGS		Contrast		SE
	Without Sucram®	With Sucram®	Without Sucram®	With Sucram®	Corn-SBM vs DDGS	With or Without Sucram®	
Day 0 to 7	0.77	0.69	0.42	0.36	<0.001	0.33	0.072
Day 7 to 14	1.05	1.02	0.49	0.40	<0.001	0.43	0.070
Day 14 to 21	1.04	1.29	0.55	0.44	<0.001	0.42	0.076
Day 0 to 21	0.95	1.00	0.49	0.40	<0.001	0.71	0.059

^aA total of 120 pigs (15 pigs per pen and 8 pens) given the choice of one of four diets in the same pen: corn-soy control with or without Sucram® and control with DDGS source 2 replacing corn, with or without Sucram®.

^{b,c}Means having different superscript letters within a row differ ($P < 0.05$).